

## CLAIMS

What is claimed is:

- 1     1.     A method of determining a parameter of interest of an earth formation using a tool  
2           conveyed in a borehole in the earth formation, the method comprising:  
3           (a)     obtaining measurements indicative of said parameter of interest with a first  
4                    resistivity measuring instrument responsive to a property of the earth  
5                    formation proximate to the borehole (near zone);  
6           (b)     determining from said measurements a first model comprising a property  
7                    of said near zone,  
8           (c)     obtaining multicomponent measurements indicative of a vertical resistivity  
9                    of said earth formation; and  
10          (d)     determining from said first model and said multicomponent measurements  
11                   said parameter of interest.  
12
- 1     2.     The method of claim 1 wherein said property of said first model comprises at least  
2           one of (i) a thicknesses of a plurality of layers, (ii) a length and resistivity of an  
3           invaded zone corresponding to said plurality of layers, and, (iii) horizontal  
4           resistivities of said earth formation outside said invaded zone.  
5
- 1     3.     The method of claim 1 wherein said parameter of interest comprises at least one  
2           of (i) a vertical resistivity of said earth formation, and, (ii) an anisotropy factor for  
3           said earth formation.

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1 4. The method of claim 1 wherein said first resistivity measuring instrument  
2 comprises a galvanic instrument.

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1 5. The method of claim 4 wherein said galvanic instrument comprises at least one of  
2 (i) a Dual Laterolog/Microlaterolog (DLL/MLL), and, (ii) a High-Definition  
3 Lateral Log/Microlaterolog (HDLL/MLL).

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1 6. The method of claim 1 wherein determining said first model comprises  
2 performing an inversion of measurements made by said first instrument.

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1 7. The method of claim 1 wherein determining said parameter of interest further  
2 comprises performing an inversion of said multicomponent measurements  
3 wherein said thicknesses of said layers, and said length and resistivity  
4 corresponding to each of said plurality of layers are fixed in said inversion.

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1 8. The method of claim 7 wherein performing said inversion further comprises  
2 defining a global objective function that is the sum of a data objective function  
3 and a model objective function.

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1 9. The method of claim 7 wherein performing said inversion further comprises using  
2 a rapid inversion algorithm.

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1 10. The method of claim 9 wherein said rapid inversion is performed substantially at  
2 the well site.

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1 11. The method of claim 1 wherein said multicomponent measurements comprise  
2 measurements made at a plurality of frequencies.

3

1 12. The method of claim 1 wherein said multicomponent measurements comprise  
2 measurements made at two frequencies.

1 13. An apparatus for use in a borehole in an earth formation for determining a  
2 parameter of interest of the earth formation, the apparatus comprising:

- 3 (a) a first resistivity measuring instrument responsive to a property of the  
4 earth formation proximate to the borehole (near zone);  
5 (b) a processor for determining from said measurements made by said first  
6 instrument a first model comprising properties of said near zone,  
7 (c) a second resistivity measuring instrument for obtaining measurements  
8 indicative of a vertical resistivity of said earth formation; and  
9 (d) a processor for determining said parameter of interest from said first  
10 model and said measurements mad by said second instrument.

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1 14. The apparatus of claim 13 wherein said first instrument comprises a galvanic  
2 instrument.

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1 15. The apparatus of claim 14 wherein said galvanic instrument comprises at least one  
2 of (i) a Dual Laterolog/Microlaterolog (DLL/MLL), and, (ii) a High-Definition  
3 Lateral Log/Microlaterolog (HDLL/MLL).

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1 16. The apparatus of claim 14 wherein said galvanic instrument comprises an array  
2 device.

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1 17. The apparatus of claim 14 wherein said second instrument comprises an  
2 induction device having a plurality of transmitter-receiver combinations,  
3 wherein at least one transmitter or at least one receiver comprises an antenna  
4 with an axis inclined to an axis of the second instrument.

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1 18. The apparatus of claim 14 wherein said model further comprises (i) thicknesses  
2 of a plurality of layers, (ii) a length and resistivity of an invaded zone  
3 corresponding to said plurality of layers, and, (iii) a horizontal resistivity of said  
4 earth formation outside said invaded zone.

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1 19. The apparatus of claim 13 wherein said parameter of interest comprises at least  
2 one of (i) a vertical resistivity of said earth formation, and, (ii) an anisotropy  
3 factor for said earth formation.

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- 1    20.    The apparatus of claim 13 wherein determining said first model comprises  
2           performing an inversion of measurements made by said first instrument.  
3
- 1    21.    The apparatus of claim 13 wherein determining said parameter of interest further  
2           comprises performing an inversion of said measurements made by said second  
3           instrument wherein said thicknesses of said layers, and said length and resistivity  
4           corresponding to each of said plurality of layers are fixed in said inversion.  
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- 1    22.    The apparatus of claim 13 wherein said processor in (d) performs said inversion  
2           substantially at the well site.  
3
- 1    23.    The apparatus of claim 13 wherein at least one of said processor in (b) and said  
2           processor in (d) is at a surface location.  
3
- 1    24.    The apparatus of claim 13 wherein at least one of said processor in (b) and said  
2           processor in (d) is at a downhole location.  
3
- 1    25.    A system for estimating a parameter of interest of an earth formation penetrated  
2           by a borehole, the system comprising:  
3           (a)    a first resistivity measuring instrument responsive to a property of the  
4                earth formation proximate to the borehole (near zone);  
5           (b)    a processor for determining from said measurements made by said first  
6                instrument a first model comprising properties of said near zone,

- 7 (c) a second resistivity measuring instrument for obtaining measurements  
8 indicative of a vertical resistivity of said earth formation;  
9 (d) a processor for determining said parameter of interest from said first  
10 model and said measurements made by said second instrument; and  
11 (e) a conveyance device for conveying said first and second instruments into  
12 said borehole.

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1 26. The system of claim 25 wherein said conveyance device comprises a wireline.

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1 27. The system of claim 25 wherein said conveyance device comprises coiled tubing.

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1 28. The system of claim 25 wherein said conveyance device comprises a drilling  
2 tubular.

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1 29. The system of claim 25 wherein said second instrument comprises an induction  
2 device having a plurality of transmitter-receiver combinations, wherein at least one  
3 transmitter or at least one receiver comprises an antenna with an axis inclined to  
4 an axis of the second instrument.

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30. The system of claim 25 further comprising an additional instrument for  
determining a parameter of interest of said earth formation.